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PROJECT CHECO SOUTHEAST ASIA REPORT

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14. ABSTRACT Project CHECO was established in 1962 to document and analyze air operations in Southeast Asia. Over the years the meaning of the acronym changed several times to reflect the escalation of operations: Current Historical Evaluation of Counterinsurgency Operations, Contemporary Historical Evaluation of Combat Operations and Contemporary Historical Examination of Current Operations. Project CHECO and other U. S. Air Force Historical study programs provided the Air Force with timely and lasting corporate insights into operational, conceptual and doctrinal lessons from the war in SEA.					
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PROJECT

Contemporary
Historical
Examination of
Current
Operations

REPORT

**CONTROL OF AIRSTRIKES
JANUARY 1967 - DECEMBER 1968**

30 JUNE 1969

HQ PACAF

**Directorate, Tactical Evaluation
CHECO Division**

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Prepared by:

MELVIN F. PORTER

Project CHECO 7th AF, DOAC

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PROJECT CHECO REPORTS

The counterinsurgency and unconventional warfare environment of Southeast Asia has resulted in the employment of USAF airpower to meet a multitude of requirements. The varied applications of airpower have involved the full spectrum of USAF aerospace vehicles, support equipment, and manpower. As a result, there has been an accumulation of operational data and experiences that, as a priority, must be collected, documented, and analyzed as to current and future impact upon USAF policies, concepts, and doctrine.

Fortunately, the value of collecting and documenting our SEA experiences was recognized at an early date. In 1962, Hq USAF directed CINCPACAF to establish an activity that would be primarily responsive to Air Staff requirements and direction, and would provide timely and analytical studies of USAF combat operations in SEA.

Project CHECO, an acronym for Contemporary Historical Examination of Current Operations, was established to meet this Air Staff requirement. Managed by Hq PACAF, with elements at Hq 7AF and 7AF/13AF, Project CHECO provides a scholarly, "on-going" historical examination, documentation, and reporting on USAF policies, concepts, and doctrine in PACOM. This CHECO report is part of the overall documentation and examination which is being accomplished. Along with the other CHECO publications, this is an authentic source for an assessment of the effectiveness of USAF airpower in PACOM.


MILTON B. ADAMS, Major General, USAF
Chief of Staff

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DEPARTMENT OF THE AIR FORCE
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FOR THE COMMANDER IN CHIEF


WARREN H. PETERSON, Colonel, USAF
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FOREWORD

Evolution of the Tactical Air Control System in Southeast Asia, its expansion and refinement, and its relationship to Command and Control in general were addressed in CHECO report, "Control of Air Strikes in SEA, 1961-1966", published on 1 March 1967. Concerned especially with out-country control of airstrikes, this second CHECO report updates Command and Control activities and actions which directly pertain to control and direction of airstrikes, such as Airborne Battlefield Command and Control Center orbits, Forward Air Controller capabilities, armed reconnaissance and--insofar as they impinge upon strike control--Rules of Engagement. Specific peripheral elements and in-country procedures pertaining to airstrike control in Southeast Asia have been profiled in other CHECO reports.

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CHAPTER I

CONTROL OVER THE BATTLE AREAS

ABCCC - The Battlefield Director

Although the concept of an Airborne Battlefield Command and Control Center (ABCCC) had been formulated, reviewed, and submitted as an operational requirement by 2 January 1964, and various partial answers, such as the RC-47 "Dogpatch" tried in SEA, the first true combat ABCCC came about in September 1965, when the initial EC-130 was deployed to Da Nang, RVN.^{1/} This first aircraft took up its orbit in the southern STEEL TIGER area, over what was to become in a few months the operational area known as TIGER HOUND. The orbit, basically a daytime orbit, operated under the Call Sign Hillsboro. Personnel were primarily TDY and were attached to Headquarters, 2d Air Division.^{2/}

The second aircraft to deploy took up its orbit over STEEL TIGER North (SL/N) to control BARREL ROLL and Route Package I, along with SL/N under the Call Sign Cricket.^{3/} Dogpatch was relegated to the role of radio relay, but other RC-47s, called "Alleycat", worked a night orbit in Laos opposite the Demilitarized Zone (DMZ) to control operations throughout Laos and NVN to the best of its limited communications capabilities.^{4/} Following the acquisition of sufficient EC-130s, the Alleycat orbit was assumed by ABCCC in June 67.^{5/} Concurrently, three of the aircraft were transferred to Udorn for beddown on 15 June, because it was more convenient to the northern orbits. A rocket attack on Da Nang, however, destroyed one of the remaining ABCCC aircraft there, and seriously damaged another. To insure the survivability of the remaining five aircraft, the Hillsboro EC-130s moved from Da Nang to Udorn. It

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was not the intent of Seventh Air Force to have the ABCCC remain at Udorn, and its planned return to Da Nang was concurred with by COMUSMACV. Seventh Air Force planners changed their minds by March of 1968, however, and decided to leave the ABCCC at Udorn, apparently for survivability reasons.^{6/}

The ABCCC concept was fully developed and established by 1968, although the unit remained an Operating Location (OL) at that time, with airplanes and aircrews staging to Udorn TDY from Taiwan. On 25 January 1968, PACAF Special Order G-26 activated the Seventh Airborne Command and Control Squadron (ACCS), effective as of 1 March, with the unit to remain permanently at Udorn RTAFB, Thailand.^{7/}

In another major change, a second night orbit was approved in mid-December 1967, to orbit in the Hillsboro area, enabling Alleycat to shift farther north for better coverage of BARREL ROLL. The orbit was named "Moonbeam", and actually began operations in February 1968.^{8/} (The orbit was suspended in May, and resumed operations in August after modifications were performed.)^{9/} Although planning for Moonbeam had come about as a result of the MUSCLE SHOALS/IGLOO WHITE sensor program, it actually was activated to control the intense air activity during the long siege of Khe Sanh, Operation NIAGARA.^{10/} Its value was demonstrated amply during this critical operation which, from its beginning on 22 January until its termination on 31 March, received more than 24,000 tactical airstrike sorties and 2,500 ARC LIGHT sorties. These missions were FAC directed, MSQ and TPQ directed (USAF and USMC ground-based radar bombing), and on occasion flight leader directed, and comprised strike assets of USAF, USN, and USMC forces.^{11/} The Moonbeam ABCCC (along with Hillsboro in the daytime), as an

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extension of 7AF TACC, was to directly control all air operations in NIAGARA, with the exception of those Marine sorties used as close air support for Marine ground forces.^{12/} With Moonbeam and Hillsboro coordinating and controlling air-strikes, some of the most impressive Battle Damage Assessment (BDA) of the war was registered. As an example, ABCCC mission reports for 15 February 1968 showed one target area about ten miles southwest of Khe Sanh (XD 765227 UTM Coords), in which strikes uncovered 200 meters of underground trenches stacked with hundreds of crates and boxes of ammunition which yielded "well over 1,000 secondary explosions and fires."^{13/}

The question of airborne control versus ground control came up in late 1967, when the sophisticated infiltration detection system, later to be known as IGLOO WHITE, achieved operational capability. The COMMANDO HUNT campaign, covering the east central panhandle of Laos, was destined to have a profound effect on ABCCC operations. The plan, based upon an electronic sensor system to detect movers (truck traffic along the Ho Chi Minh Trail), marked off an important segment of The Trail for sensor emplacement and also provided for a readout station at Nakhon Phanom RTAFB, Thailand.^{14/}

The operation at Nakhon Phanom, designated Task Force Alpha, raised questions in higher circles regarding the feasibility of replacing the ABCCC with a ground control unit, at least for the area of emplacement. Seventh Air Force conducted an exhaustive study which resulted in the recommendation that the ABCCC continue to conduct air operations in Laos, and in Route Package I of North Vietnam, with Task Force Alpha (TFA) serving as a valuable additional source of target information.^{15/}

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The controversy did not end with the 7AF recommendation, however. By September 1968, plans had been formulated to turn over control of air resources to TFA for those assets which would be operating in the area to be later called COMMANDO HUNT--that section of STEEL TIGER between 16°30'N and 18°00'N, and adjacent to the borders of North and South Vietnam.^{16/} In October, a Combat Operations Center (COC) was set up in Task Force Alpha. This COC, called Sycamore Control, was an extension of the 7AF Command Center, but was given direct control of all air resources operating in the COMMANDO HUNT area, with the aim of making more rapid use of the sensor information developed by the IGLOO WHITE system.^{17/}

The ABCCC orbits continued to exercise control function over the other Laotian areas, STEEL TIGER South and BARREL ROLL, as well as RP I until the cessation of bombing over North Vietnam. On occasion, Hillsboro and Moonbeam were even called upon to coordinate air action over South Vietnam, as on 12 May 1968, when the Kham Duc Special Forces Camp was being overrun. At 0900H, Hillsboro was directed to assume control of the Kham Duc operation. Twenty minutes later, he put in his first fighter strike, and within one hour had controlled ten in-country and six out-country strikes. By 1900H, Hillsboro had controlled some 102 in-country and 36 out-country strikes related to the Kham Duc area and its evacuation.^{18/}

The cessation of U.S. bombing over North Vietnam caused a further reorientation of ABCCC activities. The combat air operations shifted to the more limited target system within the confines of Laos, excluding the special area of COMMANDO HUNT operations, which operated under Sycamore Control during the

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late stages of 1968.^{19/}

The Frag

The frag order, issued daily by the Hq 7AF DOCHF, was the standard link between the Headquarters planners and the battlefield directors, the ABCCC. All strike aircraft checked in with the appropriate control agency--normally the ABCCC--upon entering the area, and it was up to the airborne orbit commander, depending upon the battlefield situation, to divert the incoming aircraft, assign them to a FAC as necessary, or send them to COMBAT SKYSPOT (CSS), if need be. However, each incoming strike aircraft was fully fragged upon arrival with a primary, a first and second alternate target, a TOT and, as closely as possible, proper ordnance for the primary target.^{20/}

If matters were proceeding normally; that is, if weather and visibility were suitable, the FAC was not overloaded, ordnance and fuel considerations were acceptable, then the ABCCC would direct the fighter to the proper FAC and the target would be struck under visual conditions and FAC control. If the above conditions could not be met, then the ABCCC could direct the fighters to a FAC over their secondary target, or could direct them to a COMBAT SKYSPOT OL for a MSQ-77 radar directed strike, often against their fragged primary target. Commando Nail (internal radar bombing) or LORAN bombing, for those aircraft suitably equipped, could also be directed.^{21/}

In addition to the fighters, the Frag Branch at Seventh Air Force also fragged the gunships, AC-130 "Spectres" and NC-123 "Tritons" for night route reconnaissance, with additions or deletions to fit the known or forecast situation. These frags included a Time-on-Station and a Time-off-Station over

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whatever route segment they were fragged to. To avoid conflict and subsequent possible area congestion, the only others fragged into these night gunship sections were the FAC and the flak suppression aircraft. Flak suppression aircraft accompanying the NC-123s were A-1s, whose loiter time enabled them to stay with the Tritons for extended periods. The F-4s covering the AC-130s were fragged as three-ship missions, so that one could be on a tanker refueling while the others remained with the Spectre, thus providing constant coverage.^{22/} The Triton aircraft were not true gunships but dispensed CBU-24/BLU-26 bomblets upon detection of vehicle traffic by IR, LLLTV, MTI radar or Black Crow vehicle ignition detector. It was later designated the AC-123; later still, it was returned to CONUS for rehabilitation.^{23/}

Navy and Marine A-6s were often fragged on a three-fold mission. Their Airborne Moving Target Indicator (AMTI) radar gave them the potential of acquiring any vehicles moving at five miles an hour or more, at night or in weather conditions. This gave them an all-weather armed route reconnaissance capability; however, they were also fragged to seed MK-36 mines against Traffic Control Points (TCPs) by Commando Nail, and to bomb Perishable Area Targets (PATs), also by Commando Nail procedures.^{24/}

The fragging system was not without drawbacks, many of which could not be laid to the system itself but to the fluid nature of the war. It was incumbent upon the frag branch to provide a smooth and orderly flow of aircraft into the target area, especially during periods of high activity. However, since the frag was prepared 36 to 48 hours ahead of the missions, oftentimes it tended to lag behind battlefield events or, for that matter, unforeseen operational

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changes. One Tactical Fighter Wing noted in a report: ^{25/}

"This is most apparent when something out of the ordinary occurs, such as special operations or when an organization changes ordnance. The changes do not seem to reach the operating level in time to be effective, consequently confusion is bound to result. Enough flexibility should be built into the system so that special operations can be conducted with efficiency. When frag changes occur, it is important that a special effort be made to notify the affected agencies at the operator level, otherwise the effect of the change is lost and inefficiency results."

In actuality, the flexibility inherent in the ABCCC/FAC/CSS control capabilities went a long way toward making up for any possible deficiencies in the fragging system. In any event, the system was not designed to provide real time direction, but to provide a solid and orderly basis for continuing the flow of strike assets to their areas of use. Inevitably, time was consumed in the determination of what assets would be available, the ordnance available to them, and the matching of these assets to known and forecast targets. Added to this time was the time required for rechecking to avoid conflicts, and for publication and dissemination of the frag. Upon receipt by the operating bases, ^{26/} time was necessary for uploading aircraft and scheduling the missions and crews.

In any event, the preplanning and thought that preceded the actual fragging was both detailed and thorough. A typical DOC Strike Planning Meeting (held each morning at 1000H at 7AF) consisted of the following subjects, given in the form of stand-up briefings to the Director of Combat Operations: ^{27/}

- Ordnance allocations, expenditures and stocks on hand at the various bases were discussed, with questions and answers regarding specific munitions.

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- . Weather briefing covering the previous day's weather and the weather of the upcoming frag date, with climatology extending approximately a week ahead; basically target weather.
- . Antiaircraft Artillery Order of Battle (AAAOB) for BARREL ROLL and STEEL TIGER.
- . BDA for previous day's strikes, BARREL ROLL, STEEL TIGER North, and STEEL TIGER South.
- . Chart displays showing working areas for the next frag date, 36 to 48 hours ahead, along with general fragging of FACs and armed reconnaissance route segments.
- . ARC LIGHT forecast for two days, under MSQ direction. (This assumed importance to fraggers, since the ARC LIGHT strikes "froze" two MSQ sites--one primary and one backup--for approximately two hours each, during which time Tac air strikes could not be fragged for those particular OLs.)
- . Report on visual acquisition of vehicles in STEEL TIGER North (SL/N) for the previous reportable 24-hour period. Followed by the Infiltration Surveillance Center (ISC) report on sensor activations.
- . Report on visual sighting of enemy vehicles in STEEL TIGER South (SL/S).
- . Report on recent sensor emplacements, including whether successful or unsuccessful.
- . Reports on strikes (fragged versus struck) plus Mk-36 seedings, etc; BDA involving LOCs, storage areas, PATs in SL/N; largely Intelligence.
- . Follow on of intent for SL/N for next frag date. Discussed CSS/CN/LORAN all-weather drops.
- . BDA reports, fragged versus struck, in STEEL TIGER South for previous day's strikes. Followed with general intent for upcoming frag date.

It was only after such thorough prebriefing and preplanning that the frag teams got to work on the nuts and bolts job of piecing the upcoming frag order together. When completed, the finished product was sent to all participating

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agencies, laterally to the action units and vertically to all elements of the command chain. It was nowhere intended to be an exact template of what was to happen 48 hours later in the battle arena; it did, however, present a usable pattern from which the ABCCCs and other controlling agencies could fashion an effective and responsive airstrike capability.^{28/}

Other Control Agencies

Since the bombing reduction announced on 1 April 68, and certainly after the total halt in bombing of North Vietnam on 1 November 1968, the ABCCC orbits had out-country primacy as control agency under the overall command direction of Blue Chip, the 7AF Command Center.^{29/} For expediency, flying safety, and-- in the case of COMMANDO HUNT--in an attempt to gain real time advantage of sensor information, other agencies and subagencies also carried varying degrees of control responsibility.

As mentioned previously, Sycamore was TFA's control agency covering the COMMANDO HUNT area. Although COMMANDO HUNT was not officially implemented until 15 November, Sycamore and the COC began operations on 22 October 68. To smooth the transition, ABCCC controllers from 7th ACCS at Udorn came to TFA on temporary duty to work with the Sycamore controllers, until they became proficient on their own.^{30/}

Sycamore was faced with foreseeable problems. Although the COMMANDO HUNT area was relatively small, the ground-based radio equipment of Sycamore was often attenuated when aircraft were working in the southern reaches. Relays through the ABCCC were often necessary and added one more step in the control function. This same problem tended to introduce an operational inflexibility,

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in that COMMANDO HUNT could not be moved south or enlarged to suit the changing tactical picture; any further extension of range would make relaying through ABCCC necessary for all communications.^{31/}

With increased familiarization, however, the Sycamore operation did improve within its own limitations. It did not have radar capability as did Invert or the other CRCs and CRPs, and it did not have the mobility of the ABCCCs, but it conscientiously controlled the COMMANDO HUNT area, and drew praise from FACs and other pilots who worked under Sycamore Control. For the "Slow Mover" FACs, especially, those who often worked at the far fringe of radio and radar coverage and at low altitudes, Sycamore's conscientiousness was greatly appreciated. One "Nail" FAC, from the 23d Tactical Air Support Squadron (TASS) at NKP, commented upon this during a discussion about airspace saturation:^{32/}

"We were very close to the Sycamore controllers because they were from the same unit where we were located, and we could talk to them about our problems...One thing Sycamore Control did was assign a FAC to a sector, and hold him to his word he would stay in that sector and control that sector to the best of his ability. When this was done, the 'slow mover' FAC...could fairly well control his area without fear of being run over."

The MSQs

With the exception of ARC LIGHT B-52 strikes, it was always considered preferable to have targets acquired visually, and ordnance delivered visually under FAC control. Whenever weather and visibility permitted, this was the norm. However, when target weather was inclement, the capability remained for ordnance to be delivered relatively accurately under control of the MSQ-77

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ground radar bombing system. Originally developed as a radar scoring system for the Strategic Air Command (MSQ-35), it was determined that--by reversing the process, directing the bombing rather than simply scoring the run--a usable all-weather bombing system was feasible.

The actual accuracy of the system was dependent upon several exterior factors: the range and altitude of the aircraft being controlled, whether the aircraft were transponder-equipped, and such things as target weather and winds. If aircraft were transponder-equipped (as were all B-52s and most tactical strike fighters in the USAF inventory), then a range of 190 nautical miles was possible with an aircraft altitude of 35,000 feet. At maximum range, MSQ controllers in Southeast Asia felt they could achieve a Circular Error Average (CEA) of around 1,200 feet. Working strike fighters at 20,000 feet within a reasonable range (within approximately 125-NM for example), knowledgeable MSQ operators figured for an electronically scored CEA of about 300 feet and an actual CEA of around 600 feet.^{33/}

Working with aircraft using "skin paint" gave accuracy figures of the same order but ranges were drastically reduced. Fifty nautical miles were considered a fair figure. Marine and Navy aircraft were not transponder compatible with the Air Force MSQs and therefore were worked in this manner. (USAF aircraft were in the same position when being controlled by USMC TPQ-10 radar equipment.)^{34/}

A factor that tended to degrade COMBAT SKYSPOT accuracy was the inaccuracy of the maps of Southeast Asia, particularly in Laos and northeastern South Vietnam. If the coordinates cranked into the thumb wheels of the MSQ equipment were incorrect, that was where the bombs would be released, and although

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electronic scoring could indicate a CEA of 300 feet, the impact area could be on the order of 3,000 feet away from the intended target. And this actually occurred.^{35/}

Discussions with Lt. Col. Henry G. Hostetter, Special Assistant to the Commander, 7AF, at TFA confirmed this. He said:^{36/}

"They found out that in several areas, TCPs, showed actual impacts were several hundred yards offset from the intended impact points--often in the same direction and often approximately the same distance off. Other areas, especially those along prominent streams and valleys, were quite accurate. It appeared that in the mapping, some of the more difficult areas were simply estimated.

"As one example, one TCP had been Skyspotted repeatedly, without apparently doing any good. The traffic kept coming through. One day an F-4, coming back toward home plate, was asked to visually overfly it while one of the MSQ sites followed him through on his run. It turned out that the map coordinates they had been Skyspotting were about a mile or so off. Following this, their drops in that area were far more accurate."

Personnel of the 1st Combat Evaluation Group, Detachment 15, at Tan Son Nhut AB, also pointed this out. They indicated that by trial and error, and help from the Aeronautical Chart and Information Center (ACIC) people, several areas had been updated by ACIC and the MSQ operators so that--although the targeters did not need to change coordinates--the OL itself could apply proper corrective factors prior to the runs.^{37/}

It took an Operating Location approximately 20 minutes to accept and work a Tac air mission, from the time it was given the mission until bomb impact. In a maximum effort, a site could work five missions an hour. This was not the

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case with ARC LIGHT missions. One ARC LIGHT mission "froze" two OLs from an hour and ten minutes to two hours, since all MSQ directed B-52 strikes used a back-up station which could not then accept any other traffic during the course of the mission. ^{38/}

Ordnance itself could affect the time needed to execute a COMBAT SKYSPOT. Each ordnance type had its own ballistic characteristics, with different rates of fall, dispersion, and ballistic arcs. The MSQ operators computed actual ranges (ARs) from the ballistics tables for each munition and placed AR lines on the plot sheets. If all ordnance to be dropped on a mission were the same, no problem existed; the mission could be executed in one run. If however, ordnance loads were mixed, such as CBUs and M-117s, they could not be dropped on the same run since their points of impact would differ significantly. In such a case, one type of ordnance was released, then the aircraft would return to the IP for a second run. Generation of the ground radar bombing system, the TSQ-96, was soon to electronically compute ballistics entirely, thus making manual computation unnecessary. ^{39/}

It was mandatory for each OL executing a COMBAT SKYSPOT to check back with ABCCC (or some other controlling agency) five minutes before bomb release to insure that the target clearance remained in effect. It was possible that friendly troops or noncombatants could have moved into the target area or buffer zone. Since it was also conceivable that radio or other communication difficulties could have prevented this from being relayed to the MSQ locations, a positive answer was necessary on this five-minute check. Silence constituted sufficient reason to abort the strike. On occasion, sorties were lost for this

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reason if, for example, the ABCCC failed to come up on frequency.^{40/}

Also, at five minutes prior to a Tac air COMBAT SKYSPOT release, the OL broadcast an "Artillery Warning" on guard frequency. If the strike were an ARC LIGHT mission, the warning was published in the Frag as a "Heavy Artillery Warning" and broadcast 15 minutes before the drop. The radio frequencies used by the OLs included VHF and UHF for the tactical fighters, and added High Frequency Single Sideband (HF SSB) for B-52 strikes. All sites were being made Seek Silence capable (secure voice), although it had not generally been put into use, since most fighters had not been modified with this equipment. When executing Tac air SKYSPOT, they could discuss target and mission information in the clear, if it were within one hour of the strike. Although the SAC bombers flew at 30,000 to 37,000 feet, and the fighters normally dropped from 20,000 feet, approximately, the secure voice equipment tended to attenuate transmission strength, and if not required would not normally be used.^{41/}

The MSQ-77 OLs in Southeast Asia, to all intents and purposes, effectively blanketed all of South Vietnam, a significant portion of North Vietnam, all of southern Laos (STEEL TIGER), and much of northern Laos (BARREL ROLL). By number and name, at the end of 1968, the sites were:^{42/}

OL-21	Macon	Bien Hoa, RVN	Covered all of III CTZ and much of IV CTZ
OL-24	Milky	Hue Phubai, RVN	All of I Corps, most of RP I and, except where terrain masked, much of the STEEL TIGER area of Laos.

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COMBAT SKYSPOT

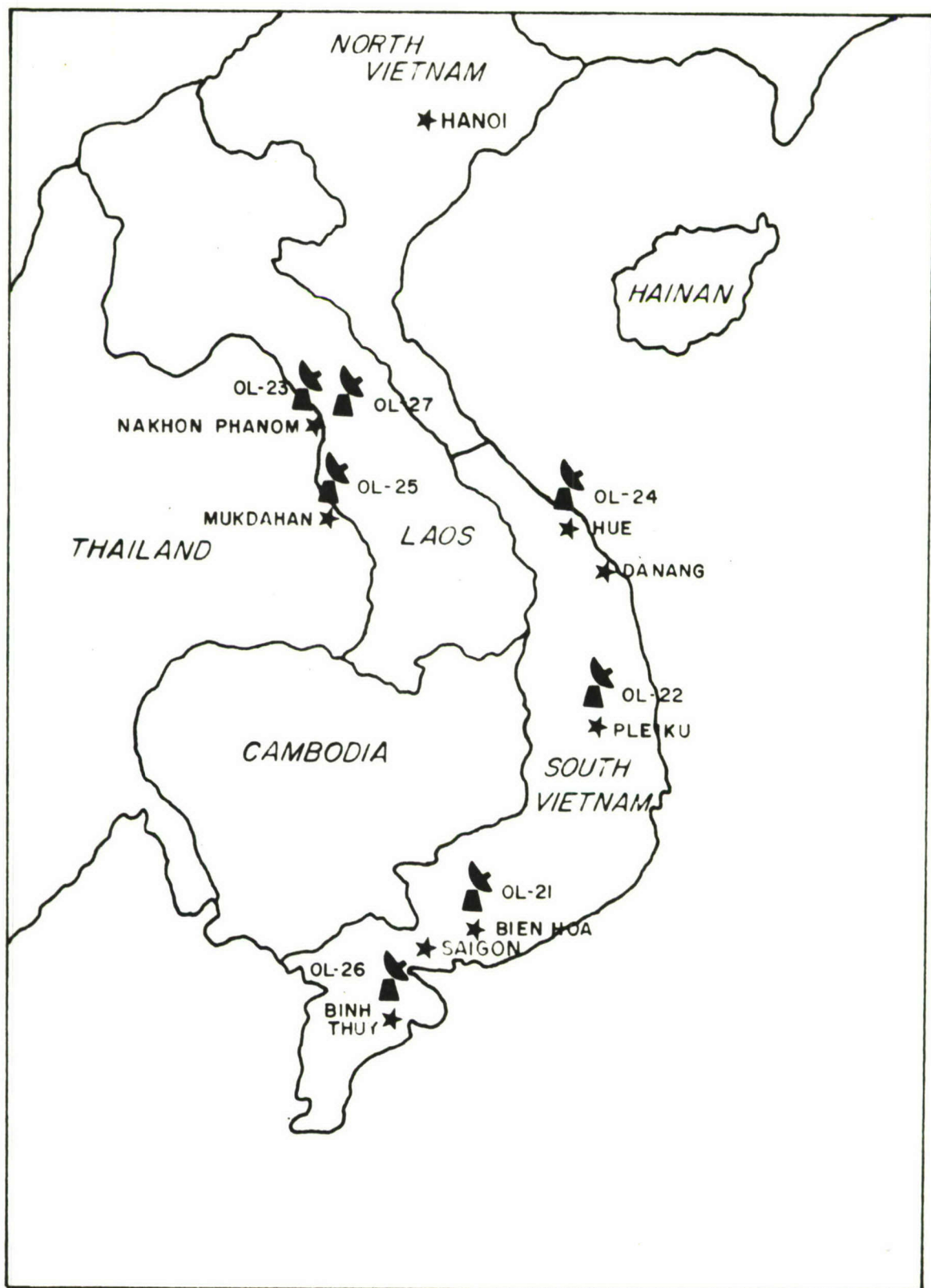


FIGURE 2

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OL-23	Lid	Nakhon Phanom, Thailand	All of STEEL TIGER south to the Saravane region; except for masking, much of BARREL ROLL as far north as Xieng Khoang. A significant gap in the coverage was the Muang Soui/Luang Prabang area.
OL-22	Bongo	Pleiku, RVN	All of II Corps Tactical Zone, extreme southern Laos.
OL-25	Teepee	Mukdahan, Thai	Operated from Quang Tri, RVN, until 27 Nov 68 when it was moved to Mukdahan and became operational 31 Dec 68. Essentially duplicated OLs 23 and 27's coverage of southern Laos, but did not extend as far north.
OL-26	Gap	Binh Thuy, RVN	Coverage included all of IV CTZ and III Corps as far north as Tay Ninh, Xuan Loc, and Phan Thiet.
OL-27	Bromo	Nakhon Phanom, Thailand	Basically identical coverage as Lid. Between the two OLs, they made 13,628 drops in 1968, for a 95.3 percent reliability factor.

The most comparable Marine facility to the MSQ-77 was the AN/TPQ-10, several of which were located in I Corps at such places as Dong Ha, Hue Phu Bai, and Da Nang. These Air Support Radar Teams (ASRTs) were subordinate control agencies accomplishing the same function as the MSQs--precision all-weather bombing; however, the TPQ-10 was far shorter in range. With aircraft equipped with X-band transponders, the TPQ-10 could reach out only to 40 NM, and to 20 NM using radar skin returns.^{43/}

CRCs/CRPs

The Control and Reporting Centers, and Control and Reporting Posts (CRCs/CRPs), were not in the business of controlling airstrikes; they were, however,

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an indispensable link in the chain. From the time of take-off until a strike flight checked in with ABCCC, rendezvoused with a FAC, or was turned over to one of the MSQ sites for direction, it was necessary that these aircraft be accorded some form of positive or near-positive traffic control, both for flying safety and for orderly flow of strike and support assets. For several years, in-country procedures had been refined. The strike sortie rates in South Vietnam remained relatively stable through 1967, 1968, and 1969, ranging between 9,000 and 11,000 per month (300 to 365 a day), and with the exception of key operations and pitched battles such as Khe Sanh, Kham Duc, and Duc Lap, these sorties were relatively evenly spaced throughout the Republic.^{44/}

With full radar overlap in-country, and constantly improving interface of communications, the CRCs and CRPs normally found the control of tactical air traffic fairly routine. The Control and Reporting Centers at Saigon (Paris Control) and Da Nang (Panama), and the Control and Reporting Posts (Pleiku, Peacock; Ban Me Thout, Pyramid; Binh Thuy, Paddy; Hon Tre Island, Port Call; Dong Ha, Waterboy) spread throughout the country were adequate not only to control tactical strike traffic, but to control the off-airways traffic of other support functions such as FACs, reconnaissance, and airlift.^{45/}

A different situation existed with the CRCs/CRPs in Thailand. Prior to the bombing halt, these Thai-based units were primarily engaged in twice-a-day waves of aircraft to and from targets in North Vietnam, with the primary service rendered being the control of refueling rendezvous.^{46/} After 1 November 1968, and especially following the intensified interdiction program in COMMANDO HUNT (officially initiated on 15 November), the CRPs in Thailand found themselves

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involved with a round-the-clock flow of traffic. Refueling was no longer a single, massive pre-entry/post-exit operation but a continual 24-hour-a-day business. The bulk of this traffic was handled by Invert at Nakhon Phanom, Lion at Ubon, and Brigham at Udorn. Invert, the CRP at Nakhon Phanom, was most drastically affected by the COMMANDO HUNT operation.^{47/}

Previously, Invert had been responsible for part-time control of Peach refueling anchor and radar monitoring, and rarely required more than two controllers in operations at any one time. By 15 November 68, Invert was involved with 350 to 400 strike sorties going into COMMANDO HUNT daily, in addition to an average of 300 FAC sorties per month, the checking in and out of ABCCCs, and the refueling tracks. Invert also had responsibility for monitoring the NVN border and issuing border warnings, and constant coordination with Sycamore, the command agency for COMMANDO HUNT.^{48/}

As an illustration of the sudden load thrust upon Invert, this single CRP was controlling as many strikes into COMMANDO HUNT as two CRCs and four CRPs were controlling in all of South Vietnam. The COMMANDO HUNT area, approximately 30 miles wide by 90 miles long, was about the same size as the two northernmost provinces of I Corps--Quang Tri and Thua Thien--in SVN.^{49/} Mission statistics for the first 15 days of the COMMANDO HUNT operation showed that Invert provided radar monitor or control for the following:^{50/}

Jet strike sorties	3236
Prop strike sorties	481
COMBAT SKYSPOT sorties	1421
Support sorties	98
FAC sorties	700
Reconnaissance sorties	340
TOTAL	6276

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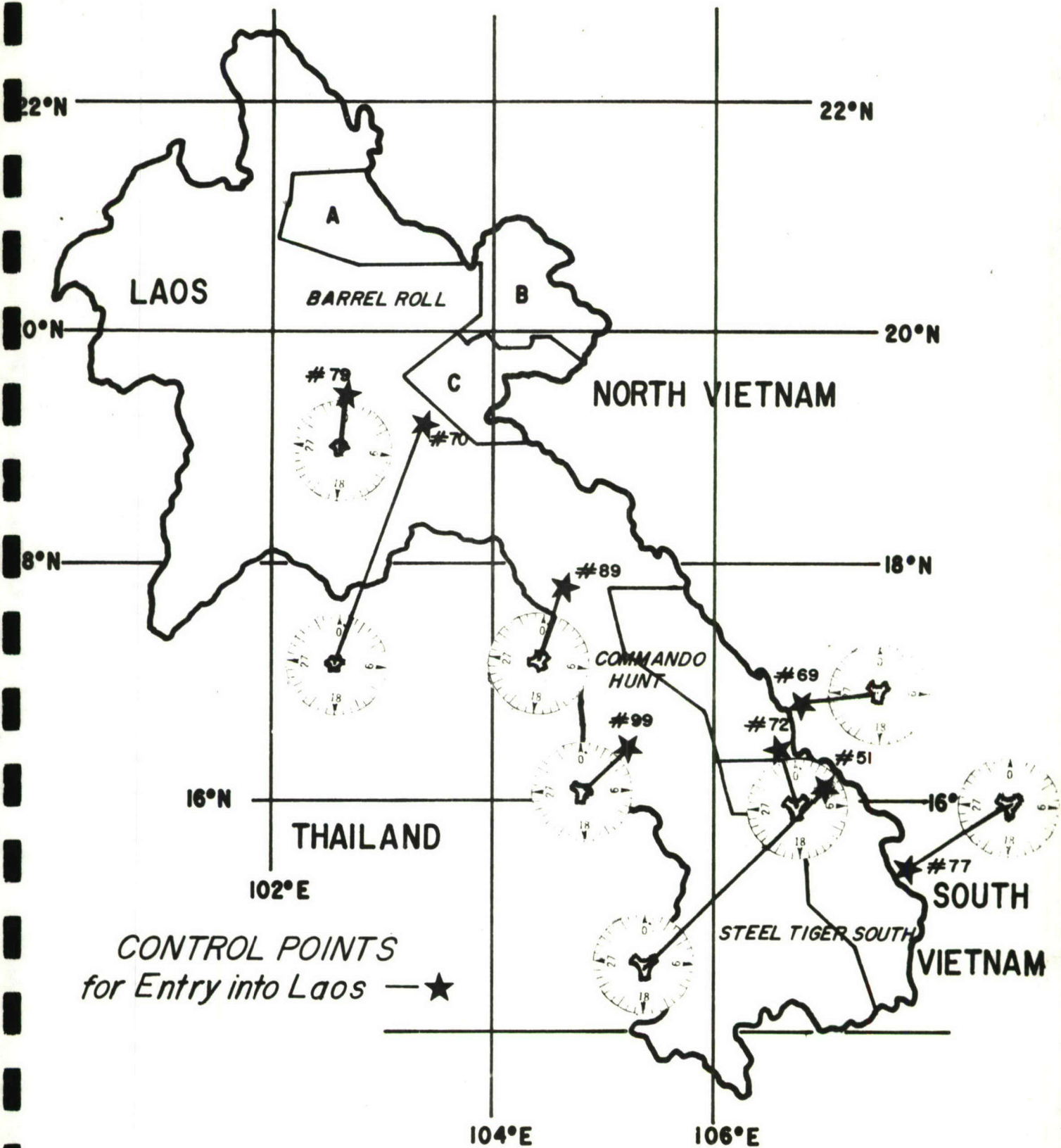
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The largest immediate problem affecting this and other Thailand CRCs and CRPs (Brigham at Udorn and Dressy Lady at Green Hill were CRCs; all others were CRPs) was that of educating controllers and aircrews in the necessary procedures to use. While the TACS in South Vietnam had long been involved with radar monitor and control of similar numbers of such sorties, there had never been as heavy a load in such a confined area (excepting shorter term operations such as THOR, NEUTRALIZE, NIAGARA, etc.). Invert's method of handling the flow centered around three radar scopes--one tactical radar monitor scope and two area control scopes. The tactical radar monitor scope accepted handoffs from adjacent units (Brigham, Lion) and monitored flights en route to the COMMANDO HUNT area. The controller at this position passed target information to the flights, then handed them off to the appropriate area control scope, depending upon the target area. This controller then provided vectors to FACs or target areas, providing altitude separation and traffic advisories. Upon completion of the strike (or other mission), flights would be given back to the area controller for handoff to the tactical air controller or other agencies for exit, refueling, or recovery.^{51/}

Several problems were encountered; among them, some aircrews were not keeping Invert informed of their actions; there was a definite conflict between low altitude-high speed reconnaissance aircraft traversing the area and the FAC or strike aircraft working a strike; and there was a complete tie-up of tactical control frequencies from the large amount of target information it was necessary to pass. A continuing problem was the simple saturation of airspace from so many aircraft in such a small area. Partial solutions to some of these

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difficulties came early in December 1968, with the institution of control points for aircraft entering Laos from Thailand, South Vietnam, and from carriers on Yankee Station, and changes in communications procedures.^{52/}

Eight control points were initially set up. These were identified by TACAN channels and located on TACAN DME Radials. They were as follows and went into operation as of 6 December 68:^{53/} (Fig. 3.)

CONTROL POINT Nr.	Channel	LOCATION	COORDINATES	CONTROL AGENCY
51	51	045R/65 NM	1601N/10940E	LION (Ubon)
99	99	045R/25 NM	1656N/10502E	VIKING (Mukdahan)
89	89	005R/45 NM	1807N/10443E	BRIGHAM (Udorn)
69	69	265R/45 NM	1619N/10656E	WATERBOY (Dong Ha)
77	77	240R/60 NM	1532N/10720E	PANAMA (Da Nang)
72	72	345R/35 NM	1610N/10621E	LION (Ubon)
70	70	015R/75 NM	1834N/10308E	BRIGHAM (Udorn)
79	79	360R/25 NM	1934N/10254E	BRIGHAM (Udorn)

All jet strike flights fraggged into Laos were to be assigned a control point and a control point time, which were to be listed in the daily STEEL TIGER and Alpha Frags and the 7AF Spec Ops and advisories. Each flight was to arrive at its control point at an altitude assigned by the appropriate CRC/CRP and as close to the assigned time as possible. From there, the flight was cleared to the ABCCC for the area being covered, or to Invert or Sycamore as appropriate. These agencies, in turn, would clear the flights to their targets or provide a FAC when necessary; for all-weather delivery, the flight would be turned over

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to the MSQ site and given a vector to the Initial Point (IP).^{54/} If the mission were to be executed as a COMBAT SKYSPOT and had not been fraggd for a discrete frequency, it was handed directly to the Invert CSS scope bypassing the overburdened primary frequency.^{55/} If the flight were to strike a target in the COMMANDO HUNT area, it was given then to Bromo or Lid, the MSQ OLs at Nakhon Phanom.

These measures, although affecting only jet strike flights directly, greatly relieved the communications congestion and reduced the amount of coordination between the various control agencies. Reconnaissance, FAC, and other non-strike aircraft were made aware of the new procedures since they did affect overall operations.^{56/}

In an attempt to solve the conflict between high-speed recon aircraft and strike/FAC aircraft, another procedure was instituted. It involved giving the reconnaissance aircraft the frequencies of each FAC along his route. The recon aircraft would then contact the FAC prior to entering the area and coordinate his passage through. The procedure was, however, totally dependent upon the reconnaissance pilot making initial contact with the CRC/CRP before beginning his run.^{57/} While this did ease coordination problems when properly followed, it did not relieve the total air space saturation.

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CHAPTER II

THE STRIKE DIRECTORS

FACs - Slow Movers and Fast Movers

Were one element to be chosen which would differentiate the use of air-power in the Southeast Asia conflict from previous wars it would most probably be the burgeoning role of the Forward Air Controller. The FAC, by other names and with emphasis perhaps on other functions (such as the light plane artillery spotter of WW II, and the "Mosquito" of the Korean conflict), had been used before but not to the extent that he was used in Southeast Asia.

The reasons for the importance of the FAC in SEA have been amply documented in other reports. Briefly, however, extensive jungle canopy camouflaged enemy encampments, movements, and intentions. This made the role of the FAC two-fold: one, to conduct visual reconnaissance of his assigned area; and two, to direct accurate airstrikes. The visual reconnaissance gained for the FAC intimate knowledge of his area, so that any movement of suspicious personnel, addition or subtraction of structures, or, in fact, any change in the physical makeup of his VR area was immediately noticeable to him.

With relatively extensive loiter time in the target area, he could direct one strike after another without subjecting the fighter pilot to the burden of locating and validating the target before striking it. The target was not "lost" between strikes, and the FAC could assess bomb damage while keeping abreast of any changes in the ground situation. When the next strike flight arrived, the FAC could put them on target with minimum delay and the expectation of maximum effectiveness. As a philosophy, this worked the same for

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in-country or out-country operations.

In practice, several things caused the out-country FAC role to differ from that developed over the years in-country. Rules of Engagement (ROE) not only differed from those in South Vietnam but differed in various parts of Laos and often changed overnight; the areas of operation ranged from wholly permissive to totally nonpermissive for the slow moving FAC. Terrain and weather posed their own problems.

To a very large degree, the end product of the air war over Laos differed from that in South Vietnam. Tactical air in RVN was largely committed to close and direct air support of ground troops. Out-country, the accent was on interdiction of the LOCs, supplies, vehicles, and personnel destined for South Vietnam. This in turn dictated different ordnance requirements, tactics, and methods of target acquisition.

The weight of effort between the two theatres for night versus day was a definite factor in both the application of strikes and the use of FACs. In-country the use of tactical air at night, with few exceptions, was defensive in nature--in support of troops in contact or outposts under attack. This limited the use of the in-country FAC. The out-country war, however, with its commitment of impeding the enemy logistics movement during darkness, used the night FAC to the extent that entire night-dedicated FAC units were formed. Among these were the Candlestick C-123 and Blindbat C-130, with their long loiter time and flare carrying capacity, but O-2A Nails and Coveys also flew night missions.

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The problem of coordinating strikes by fast movers and slow movers against the same target or in the same area paralleled the problems of fast and slow moving FACs, and was a continuing one. Slow movers could generally work in poorer weather conditions and had longer loiter time; fast mover FACs could range further afield, react faster, and were able to operate in a less permissive environment. Each had a place in the scheme of the air war.^{1/}

Ravens, Nails, and Coveys - Slow Mover Day FACs

The bulk of airstrike control during daylight hours over Laos fell to the FACs carrying these call signs. The Nail FACs were from the 23d Tactical Air Support Squadron (TASS) at Nakhon Phanom, Thailand; the Coveys from the 20th TASS at Da Nang, RVN; and the Raven FACs (a composite unit designated Detachment 1, 56th Special Operations Wing, Udorn, but in actuality dispersed at several sites throughout Laos and directly responsive to the USAIRA, Vientiane). The Ravens flew the O-1 aircraft. The Nail and Coveys transitioned from the O-1 into the O-2A during 1967. The OV-10, Call Sign Snort, was subsequently introduced to the out-country war operating primarily during the daylight hours.^{2/}

The general areas of operation for the day slow mover FACs covered Laos from Route 110 on the south to those areas of BARREL ROLL which were sufficiently permissive for the light planes to operate. Basically, the Covey FACs operated in STEEL TIGER South (TIGER HOUND), while the Nails covered STEEL TIGER North (COMMANDO HUNT). The two areas contained the major portion of LOCs leading from North Vietnam through Laos and into South Vietnam or Cambodia, and it was in these areas that the most lucrative BDA was reported. Both units, the 20th and 23d Tactical Air Support Squadrons, flew O-2s from Da Nang and Nakhon Phanom

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and from their Operating Locations at Pleiku and Ubon.^{3/} The Raven FACs, flying O-1s, had a dissimilar mission and will be treated separately.

Both Coveys and Nails had a threefold mission, as follows:^{4/}

- . Gather visual reconnaissance of enemy supply activity along major lines of communication.
- . Direct airstrikes upon enemy supply activity and lines of communication in support of the overall interdiction effort.
- . Determine airstrike results through bomb damage assessment.

The three were far more closely linked than would be apparent at first glance. Much of the success of the direction of a tactical airstrike was dependent upon the FAC's intimate knowledge of the territory he was working. As one report stated:^{5/}

"...Too often, strike aircraft are assigned to FACs that have no target and are not prepared to work. When this occurs the FAC must stop his more important function of searching for a lucrative target and expend the strike aircraft, usually on a worthless target...It is extremely important to provide the maximum amount of loiter time to each strike aircraft. Targets can then be allowed to develop, multiple passes can be made and the FAC can have the opportunity to assess each pass and provide refinements for the next, or to move on to another target if the first is destroyed."

A 20th TASS report echoed the same feeling regarding the necessity for adequate visual reconnaissance of the target area.^{6/}

"...There are cases when the FAC feels he has had insufficient time to properly VR an area prior to the expenditure of ordnance. A mutual feeling of frustration is experienced by ABCCC and the fighter pilots

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when the ordnance arrives and a proper target has not been acquired. The paradox exists when a good target has been acquired and there is no ordnance available."

FAC Tactics

The initial FAC/fighter rendezvous was accomplished by use of TACAN or the ground radar through the CRP/CRC and under normal weather conditions did not constitute a problem. The direction of airstrikes by FACs was comparable to the in-country procedures in use, except that in the STEEL TIGER and COMMANDO HUNT areas, strikes were conducted from higher altitudes. Several reasons made this practical. Among them, the presence of friendly troops in contact (therefore, the probability of a Short Round) was not usually a factor. The ever-present cliffs of near-vertical karst made flying down into the valleys a risky undertaking at best, but the primary reason lay in the possibility of intense enemy ground fire. This ranged from small arms, 12.7 and 14.5-mm heavy machine guns in some areas, up to 23, 37, 57 and even 85-mm (few) AAA in high threat areas around Routes 9, 92, 911, and 912.^{7/}

The variance in working altitudes between in-country and out-country FACs, and their basic limitations, as of late December 1968, was as follows: in-country FACs had to maintain a minimum of 1,500 feet above Ground Level (AGL), unless overriding circumstances dictated otherwise. Nail FACs worked under the criterion of 3,000 feet AGL, except in high threat areas, where their minimum was 5,500 feet. Covey FACs worked at between 6,500 and 8,500 feet indicated altitude, which placed them at an operating altitude of approximately 4,000 to 6,000 feet AGL.^{8/}

At these altitudes, the Nails and Coveys could expect to be above the range

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of small arms and .30 caliber machine guns. The O-2s were at the extreme effective range of the 12.7 (corresponding to .50 cal), but were still within the effective envelope of the 14.5-mm guns and AAA. The 20th TASS believed there was no one point within its area of operations where ground fire was not a potential threat. They noted occasions where a 23-mm or 37-mm gun would fire during a strike on vehicles where there had never been ground fire previously, and it was believed that guns were being towed behind trucks, being made ready to fire by the time the first aircraft made his strike pass. Pilots of the 23d TASS made the same observation.^{9/}

In general, target marking procedures out-country were the same as for South Vietnam, except for the altitude of delivery. The 2.75-inch White Phosphorus (WP), rocket was the standard marking device for daytime operations; in addition, terrain features, previously ignited fires in the target area and, in some cases, smoke grenades were used. During reduced visibility conditions, such as haze, or when the FAC was not certain of the strike flight's ability to positively identify the target, two markers could be put in on a specific heading. After confirmation by the strike pilot of the location and heading of the two marks, the strike could be cleared in on target.^{10/}

Although much of the radio terminology used by FACs was necessarily standard (i.e., "Olds 01, hold high and dry.", "Gunfighter 11, you are cleared.", or "Rap 22, go through dry.") to preclude Short Round incidents and insure better understanding between FACs and fighter pilots, many Forward Air Controllers had their own preferences in techniques and language used to control strikes.^{11/} One 23d TASS pilot discussed these differences:^{12/}

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"...Some say give them a definite heading, 'Run East to West, or West to East, and I'll be holding to the North, out of your way; call me in sight.' Others, myself included, I prefer to say where I am and let the fighters pick their own run in heading, if it's not essential to hitting the target. If it's a truck or storage area which I can see, and I put the smoke down fifty meters from it, I tell them where it is; I say, 'I'm moving to the North, you're cleared in, choose your own heading. Let me know what it is when you roll in.'...Typical answer is, 'I'm in from the North' or 'I'm in from the South.' Sometimes they'll give it to you in terminology which might confuse the enemy if they're listening in on the radio, such as, 'I'm in from California to New York', or 'I'm in from Mexico to Canada.'; things like this, that hopefully, if someone is listening in, and the gunners are on the same frequency, they wouldn't know which way the guys are coming in from because they wouldn't be that familiar with U.S. geography."

Ordnance

Even the ordnance fraggd and hung on fighters determined the tactics and techniques used by the FACs in directing airstrikes. That ordnance known as "hard" ordnance (M-117, M-65, MK-84, etc.)*, slick bombs was used to interdict the roads and close up the traffic control points (TCPs). This ordnance could be dropped from altitudes above the small arms fire range, 3,000 to 7,000 feet, for example, and especially with the delayed fuze, was excellent for cratering roads, and creating slides during the daytime. "Soft" ordnance, with the exception of finned napalm and CBU 24/49, required a low-altitude delivery, which, depending upon weather, terrain and enemy defenses, might or might not be difficult to deliver. However, this ordnance was most effective against personnel and vehicles. Several factors had to be considered before determining

* M-117 with fuze extender is classed as "soft" ordnance.

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the type of tactics that could be used, including the type of target, the fighter fuel remaining, and the type ordnance carried. For instance, if a fighter were carrying M-117 (750-lb GP) bombs, the weather conditions were good, and the target were a suspected truck park or storage area, a 45-degree dive and a 7,000-foot release were acceptable. For a smaller, more clearly defined target, such as a short road segment or bridge, perhaps a 30-degree dive and a 2,500-foot release might be necessary. For some ordnance and some locations, multiple passes might be made, depending upon enemy defenses and upon how lucrative the target was. ^{13/}

For seeding of MK-36 Destructor mines or MK-82 (500-lb) bombs with FMU-72 fuzes (long delay), usually all bombs were released on one pass, so that enemy reaction was not normally as important as the terrain factor. The FAC, in addition to controlling the strikes, was used to monitor the effectiveness of the interdicted area and to call for restrike when needed. ^{14/}

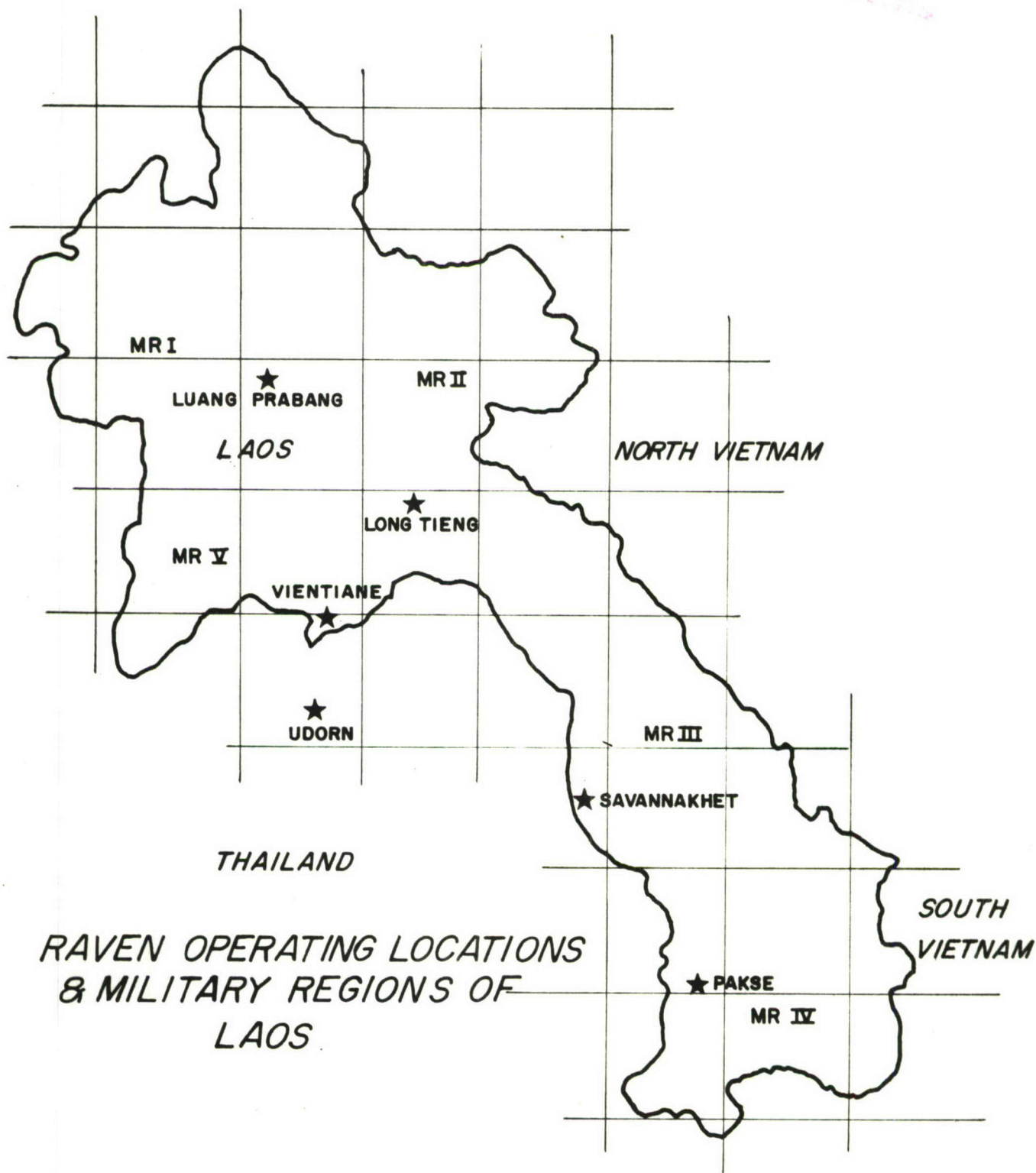
The Ravens

A different sort of FAC was the Raven. Where Nails and Coveys basically were concerned with USAF fighters, the Raven FACs worked directly under the Air Attache in Vientiane, primarily controlling Royal Laotian Air Force (RLAF) T-28s. The Ravens operated out of five locations covering the five Military Regions (MRs) of Laos. (Fig. 4.) Raven 01, at Wattay Airfield, Vientiane, was Chief FAC for the organization, which also flew from Pakse, MR IV; Savannakhet, MR III; Long Tieng, MR II; and Luang Prabang, MR I. Vientiane, actual hub of the government, was located in MR V; Luang Prabang was the Royal Capitol, and as such, enjoyed a degree of immunity from attack by NVA/PL forces. ^{15/}

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RAVEN OPERATING LOCATIONS
& MILITARY REGIONS OF
LAOS

FIGURE 4

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Unlike the Nails and Coveys, whose O-1s had been replaced by O-2As, the Raven FACs continued to fly the venerable "Birdog". The pilot was from the United States Air Force, while the second man in the aircraft was Royal Laotian Air Force, which allowed easier and more accurate communication with the ground forces.^{16/} The Raven organization was, on paper, Det 1, 56th SOW, at Udorn. In actuality, it was a composite organization using pilots from several sources--Military Assistance Program (MAP), 404 being the leading one, but bolstered by TDY FACs from several units. The organization was under direct operational control of the AIRA, Vientiane, under Project 404, Deputy Chief, JUSMAG.^{17/}

The Ravens varied in their operations from South to North. At Pakse, two Ravens worked out of the joint Lao/U.S. Air Operations Center. They were briefed by CAS and USAF intelligence sources and covered most of Route 23 from Saravane south and Route 16 to the east of Ban Tha Teng, but not over the main route structure of The Trail, which was not permissive to the O-1. Although some of their activities were directed toward the counterinsurgency effort, most of their work in the South, MR IV, was interdictive in nature. They did, however, often work closely with Special Guerrilla Units (SGUs) and Forward Air Guides (FAGs) on the ground. These often provided highly lucrative targets for air. Inasmuch as the friendly units were quite small, and artillery was nonexistent, airpower was the primary ordnance deliverer for these guerrilla bands.^{18/}

On one particular instance, 20 December 1968, two of these small SGUs encountered an entire NVA/PL company dug in along a stream bed below them. Rather

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than engage the enemy, the guerrillas called for a Raven who in turn called in strikes. The FAC, Raven 52, placed Zebra flight (F-105s) with ten 750-lb. bombs and fuze extenders on the target, along with Manual 72 and 73 (Marine) and Galeforce and Saddleback (Navy) flights. The target was a triangular area about one kilometer east of Route 23, midway between Saravane and Ban Tha Teng. When the smoke and dust had settled, the SGU troops swept the bombed area and reported 126 NVA soldiers killed. This is mentioned, not because it was such a rare occurrence, but because it was actually typical of the close coordina-^{19/}tion between the ground units, the Raven FAC, and the strike forces.

Farther north, the Ravens staged out of Lima 39, Savannakhet, with an area of operations that included western Savannakhet Province, and essentially provided FAC capability for close air support of Forces Armee Royale (FAR) in Military Region III. Most of the defenses ringed the city of Muong Phalane, and as in MR IV, tactical airpower was used more as artillery extension than as true tactical air.^{20/}

Military Region V, in which Wattay Airfield and Vientiane are located, was traditionally an area of very low-key insurgency, and as a result required only the one FAC. All three of the tripartite factions, Right, Left, and Neutral, existed in "harmony" to a greater degree than in any of the other military regions, with most of the action being political, rather than military.^{21/}

To the northwest of Vientiane Province lay Luang Prabang, Sayaboury, Phong Saly and Houa Khong Provinces, making up MR I, the northwest corner of Laos. As the western anchor to the Plaine des Jarres, Luang Prabang received

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significant insurgent action, with North Vietnamese pressure from the North of Luang Prabang.^{22/} In this portion of BARREL ROLL, usually two Ravens worked out of the airfield at Luang Prabang, Lima 54, generally with the RLAF, but when troops in contact or special packages were involved, they could call upon USAF resources.^{23/}

The most tactically significant region in Laos (outside of the interdiction areas contiguous to South Vietnam) was Military region II, largely made up of Xieng Khoang and Sam Neua (Houa Phan) Provinces. Historically, for the past four or five years, the entire military focus was upon the control of the Plaine des Jarres. For example, it was the Meo heartland. It existed as the demarkation line between the ethnic and cultural spheres influenced by the North Vietnamese on the North (Viet-Laos) and the Thais on the South (Thai-Laos). Throughout this important region, the Meos, a sub-ethnic mountain group, fierce in their loyalty to their land, if not necessarily the government in power, held forth. No match in a frontal confrontation with heavily armed and superior in number NVA troops, the Meos, under the leadership of General Vang Pao, made up one of the most effective fighting forces in Laos. It was axiomatic however, that in any pitched battle, the success of the Meo guerrillas was contingent upon effective and responsive tactical airpower.^{24/}

This was the major operating area for the Ravens, who used LS 98/30-- usually called 20 Alternate--at Long Tieng (TG 8214, UTM Coordinates), Xieng Khoang Province, for their forward staging site. The number of Ravens at Long Tieng varied, usually five or six. These gave support to FAR, SGU, and Vang Pao's troops, both guerrilla and conventional. In contrast to the predominantly

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interdictive efforts in STEEL TIGER, this air support was aimed at the heart of the Laotian civil war, which was classed as a "separate" war from the one in Vietnam. Interdiction of Pathet Lao/NVA resupply was directed at Routes 6, 7, 61, 68, 602, etc., but primarily the air effort was applied in direct or close air support of friendly forces. Standard procedure was that the Ravens worked with Cricket ABCCC and, at night on rare occasions, with Alleycat.^{25/}

The little Raven O-1s, with generally anonymous U.S. pilots in front and a Laotian observer in the backseat, were often credited with making the difference between success and failure in the saving of an outpost or in the outcome of a skirmish.

Night FACs - Blindbat and Candlestick, Nail and Covey

It had become clear early in the conflict that the best time to cut roads was during the day, and that the most likely time to find and kill trucks was at night. The enemy did not drive at night of his own choosing but for pure survival. It became quite a contest between the truck drivers and airplane drivers to see who could outwit the other. The traffic moved at night and the night FAC became a necessity for several reasons. By and large, the Rules of Engagement forbade strikes without a FAC, the FAC had long loiter time, could learn his general area, and--just as in the daytime--could control follow-on strikes one after another without losing the target.

In an environment where locating an object or target through the tangled jungle canopy was difficult even during daylight hours, it was inevitable that target acquisition devices would become more and more sophisticated for night use. This was foreshadowed as early as March 1966, when a Starlight Scope,

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jury-rigged in the open door of an AC-47, was used in the defense of the FAR post and airfield at Attapeu, Laos. With a Laotian officer aboard to validate targets, the AC-47 (Spooky 41) crew easily spotted several hundred enemy troops advancing on the friendly positions, and before the night was over, had accounted for a minimum of 100 KBA (an estimated 250) and had saved the airfield, the post, and the city itself. ^{26/}

In the years since that time, several Southeast Asia Operational Requirements (SEAORs) have been responsible for larger, better light-gathering Starlight Scopes, Low Light Level TV (LLLTV), and other highly sophisticated Night Observation Devices. These included Black Crow (ignition detector), Forward Looking Infrared (FLIR), and radar with airborne moving target indicator (AMTI) among others. Strike control tactics evolved throughout the same time frame to suit the capabilities of the target acquisition equipment, the FAC aircraft, and the various strike aircraft. Obviously some of the equipment, by reason of size alone (also, special electrical requirements, necessity to be crew-served, etc.), could not be accommodated in O-1s, O-2s, or even in OV-10s.

The C-130 "Blindbats" and C-123 "Candlesticks" were configured with the Starlight Scope, initially the small portable model developed for use with the M-16 rifle. This scope did have limitations. First, it was difficult or impossible to see trucks running with their lights off on dark nights; it was even difficult on moonless nights to make out the road structure. The Blindbat aircraft acquired the AN/AVG-3A Starlight Scope early, but the Candlesticks did not get the chance to evaluate them until July and August 1968, when they borrowed a few from Blindbat. They immediately noted a vast improvement over

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the smaller scope; truck sightings immediately climbed; and it was determined that the road structure was far easier to acquire and keep in sight.^{27/}

Orders were placed for the new scope in September, and with expedited delivery, six were delivered in December with more to come. The bigger scope was solidly mounted, steadier, and a far more efficient light gathering and amplifying device.^{28/}

One advantage of the large slow movers was their ability to carry vastly greater amounts of flares and other marking devices than the lighter FAC aircraft. As an example, the Nail O-2s were limited to the following night ordinance: seven 2.75 WP rockets (right outboard station), two MK-6 ground marks (one on each inboard station), and four MK-24 flares--six if Navy rack was used (on left outboard station).^{29/} The C-130 Blindbat, by contrast, carried 250 MK-24 parachute flares and 30 MK-6 ground marker flares ("logs").^{30/}

Night FAC coverage (along with night strike coverage) received greatly increased emphasis coincident with the bombing halt over North Vietnam, and the inception of the COMMANDO HUNT interdiction program in Laos. As an example, between 16°30'N and 18°00'N in Laos, night FAC coverage consisted--at that time--of ten Nail O-2s, six C-123 Candlesticks, and two C-130 Blindbats. This gave all-night coverage by five FAC aircraft at any one time throughout an area only 90 nautical miles long by roughly 30 NM wide.^{31/} (As adequate as this would appear, it later was determined that even more were required, both for full coverage and for traffic control.)

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Night Tactics, Target Marking, and Ordnance

Basically, the rendezvous techniques used at night were not dissimilar to daytime rendezvous. As mentioned at a Night FAC Coordination Meeting in early 1969, the most commonly used rendezvous technique was for the FAC to specify a TACAN DME and radial, completing the rendezvous by use of wing lights or flashing beacon when necessary. When the TACAN technique was ineffective because of distance from the station, or equipment malfunction, vector assistance could be requested from the CRP/CRCs, or rendezvous could be accomplished by grid coordinates or visually through prominent landmarks. As a last resort, the FAC could drop flares and talk the strike pilot to him. Using flares, however, usually eliminated any possibility of catching any trucks by surprise and was normally discouraged.^{32/}

Once the flights were mated, and the FAC had acquired a target, it was normally necessary that he mark it for the faster moving, higher flying strike aircraft. Several methods were available to the FACs, often in combination with the bombers, to do this. An O-2 FAC could roll in and mark the target with a WP rocket, then drop a flare directly over it on pulloff. This set up a gun position or an unwary truck driver strategically for the strike pilot. If he were working with a Nimrod (A-26), the O-2 might make the first mark himself, and then use the Nimrod's flares for further marking to conserve his own flare capability.^{33/}

If the FAC found a particularly lucrative string of trucks in convoy, it was often highly profitable for him to drop a pair of "logs", ground markers, one on each side of the road a few miles in front of the convoy. The truck drivers could not see the markers but both strike and FAC aircraft could orient

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themselves and prepare for the optimum time and run-in angle for the strike. Then the FAC could drop multiple flares to illuminate the entire stretch of road.^{34/}

It was pointed out that, when using multiple flares, an interval of five to ten seconds was proper for the MK-24 flare. The MK-24 illuminated an area approximately one-half mile across for three minutes. One flare every ten seconds would allow the illuminated areas to just touch; any longer interval than ten seconds would leave insufficient light between flares, while any shorter than five simply wasted them. The flares burned for three minutes, which meant that the FAC aircraft should return to the head of the string and begin dropping the next string within that time to avoid burnout prior to the next flare.^{35/}

There were several marking options available, each with its own advantages and disadvantages. The O-2 could mark with extreme accuracy using the 2.75 WP rocket, but the mark was visible for a relatively short time and strike aircraft did not always see it. The MK-6 log flare gave a long lasting mark, but it was difficult to deliver accurately and, in addition, produced a yellow glow similar to grass or wood fires. If, as was often the case, there were numerous small fires burning from previous strikes, the log flare made it difficult for the fighter pilot to tell the difference between the two. It was acknowledged by many FACs that a colored ground marker flare would greatly facilitate marking in this manner.^{36/} At the end of December 1968, colored ground markers designated the LUU-1/B had been requisitioned and began to enter the theatre soon thereafter.^{37/} Two thousand of them were due on Thai bases by late March.

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After marking of the target, and assurance that the strike aircraft were on the proper target, direction of the strike itself did not differ greatly from that found in day strikes. Extra precaution had to be taken to insure that strike and FAC aircraft occupied separate quadrants, and that the strike aircraft had a run-in and pulloff heading, which would not only clear him from the terrain, but would give him room to "jink" should he begin receiving ground fire. A series of examples given in the Nail Night Tactics Manual explained the normal tactics well. FAC instruction might sound as follows: ^{38/}

"Strike aircraft cleared to attack N-S or S-N and breaking West."

"FAC holding East." (As additional aircraft are provided for flares, flak suppression, etc.)

"Flak suppression aircraft East--over the FAC--cleared to attack upon impact of strike aircraft's ordnance and breaking opposite the direction of the FAC." (FAC should be in a single quadrant when using simultaneous strike and flak suppression aircraft.)

"Additional strike aircraft--hold high over the target area. Move aircraft down as working aircraft 'winchester' and depart."

"Additional Flareship/FAC--East above the working FAC and either above flak suppression aircraft or below and well away from the strike."

When using two aircraft simultaneously, one in the strike role and the other as flak suppression, the FAC would insure that each aircraft called "off"

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and gave his direction off. This enabled the second aircraft to plan his attack against AAA and position himself to avoid the preceding aircraft.^{39/}

Mixed ordnance loads on strike aircraft were available to the FACs, but preferences leaned strongly toward "soft" ordnance during night operations, excepting road interdiction or COMBAT SKYSPOT. It was assumed that most night strikes emphasized truck killing or AAA suppression, and for these, "hard" ordnance was considered ineffective by strike pilots and FACs alike. Favored above all other ordnance was the M-35 and M-36 "Funny Bomb", which set numerous intense fires over a large area and was ideal for convoys, truck parks and the like. Unfortunately, its availability dwindled in 1967 and stocks were to all intents and purposes depleted by the end of 1968. Of readily available "truck-busting" ordnance, CBU-24, napalm (finned), MK-82/FE (with fuze extender), 2.75 rockets, and 20-mm were generally highly thought of, although each unit had its own preferences.^{40/}

Ordnance used by USN and USMC strike aircraft, but not yet available in the USAF inventory, were Rockeye and the Zuni rocket. Rockeye, a CBU-type munition, resembled an antitank grenade and contained a shaped charge capable of punching through cold-rolled steel. The Zuni was a five-inch High Velocity Aerial Rocket (HVAR) rocket employed with good results. One drawback mentioned regarding rockets was that the pilot was essentially blinded following firing at night.^{41/}

For flak suppression, truck-busting, or truck park saturation, area munitions were definitely preferred by FACs and strike pilots alike.^{42/}

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The Fast Mover FACs

Until late spring of 1967, control of airstrikes in Route Package I and the DMZ were conducted by TALLY HO O-1 FACs. As the area became less and less permissive, the O-1s were relegated to the western, more mountainous areas, while A-1s took over the most heavily defended eastern side. Finally, it was conceded that RP I was nonpermissive for reciprocal engined aircraft, at least in the FAC and VR roles. ^{43/}

In June 1967, the COMMANDO SABRE operations began, using F-100F "Misty" FACs to control strikes in RP I. This was the beginning of all fast mover FACs. With their higher probability of survival, the Misties rapidly proved the value of FACs using jets to control strike aircraft in high threat areas. ^{44/}

The Misty FACs were from the 37th Tactical Fighter Wing at Phu Cat, RVN. By August 68, pilots of the 37th TFW had cross-trained with crews of the 366th TFW at Da Nang to form the first F-4 fast mover FACs. These were the "Stormies", which began their operations in September 1968. The third of the fast movers, "Wolf", was formed and began operations in November 1968, at the 8th TFW, Ubon, Thailand. ^{45/}

After the 1 November 1968 bombing halt, the fast movers made the more heavily defended LOCs in Laos their bailiwick. Along with the Snorts (OV-10s), they took on a variety of specialized missions in areas where the slow movers found it difficult to survive, and whenever great coverage was necessary. ^{46/}

The advantages of the fast mover FACs were inherent in their speed; they could traverse from one point to another in a minimum period of time. The Director of Operations for the 7th ACCS (ABCCC) at Udorn, Col. Edward J. Kinney,

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said: ^{47/}

"The area of operations for the fast mover FAC, of course, is considerably larger than the slow mover FAC, and this is obvious because of the speeds at which the fast mover can operate, and also the length of time that he can stay on station. At present (because of air-to-air refueling), we are receiving up to four and a half hours, normally, on a fast mover FAC...whereas the slow movers run anyplace from two to three hours maximum time.

"The slow mover FAC has a very definite position in this particular operation, inasmuch as he has a great deal more time for visual recce. He'll go out and try to get down lower into the canopy areas where he can see storage areas, truck parks, and such as this. The fast mover does have a deficiency in that respect. The slow mover gets more detail as a general rule. However, I feel there is a definite place for both the slow mover and the fast mover in this operation at the present time, and will remain so in the future."

The Biggest Problem - Airspace Saturation

Little doubt existed that one of the most vexing, hazardous, and difficult-to-solve problem areas lay in airspace saturation of congested and confined target areas. Lucrative targets were not scattered at random around the 90,000 square miles of Laos, but tended to be located in clusters around fairly well-defined lines of communication, areas of conflict, and centers of enemy strength. The saturation was aggravated by several other factors such as differences in aircraft speed and loiter time, weather conditions, poor communications, dissimilar missions taking place simultaneously, etc. The situation was at its worst immediately following the bombing halt over the north, when an increased number of strike resources were fraggged into the narrow STEEL TIGER area of Laos, contiguous to North and South Vietnam. Improving control procedures,

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coordination between control agencies, and a growing awareness of "the other guy's problems" went a long way toward alleviating some of the problems. Some, however, remained to plague aircrews and planners alike.

Some stories related by FACs of the near misses were hair raising. One Nail FAC recounted: ^{48/}

"I was operating in what is now Sector Four in STEEL TIGER, VR Sector 4 just south of Interdiction Point Foxtrot. There was myself and another FAC working the area. The other FAC had just arrived in the area, and I was trying to show him the target they had found along the river, which was a barge. I was orbiting the barge at about 6,500 feet when I felt the shock wave of the airplane. My first thought was that I had been hit by ground fire for sure. I could hear a sort of a boom and it inverted my airplane from the shockwave, and my first thought was where to go to get out of the airplane. When upside down, looking at the ground, I saw an F-4 which... had missed me by what had to be less than ten feet."

There were mid-air collisions. The 31st TFW at Tuy Hoa, RVN, lost an F-100 due to a mid-air with the FAC over STEEL TIGER in November. Both pilots, ^{49/} fortunately, were rescued. Several things could lead to such instances, or to near misses over the target. Aircraft coming from long distances arrived in the target area with a minimum amount of "play time" remaining before bingo fuel, and thus had to expend ordnance hurriedly, or return to base with it. In the event a strike flight was expended without adequate briefing and coordination with the FAC, not only was the kill probability reduced, but flying safety ^{50/} was inordinately compromised.

As a headache often reinforces itself through tension and pressure, so delays created congestion over the targets, and congestion in turn created further delays. This was especially noticeable during the night, when the

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slow mover strike aircraft such as Zorro A-1s, and Nimrod A-26s (generally conceded to be superior truck killers to fast movers) had to orbit off-target while fast mover diverts, having limited loiter time, were given priority handling by area FACs. While the conventional aircraft pulled off the targets so that the fast movers could expend prior to bingo fuel, often the targets were lost, or BDA failed to measure up to that which could have been gained. ^{51/}

The saturation problem was recognized by all control agencies and concerted efforts were made to alleviate the problem. The "Control Points" solution helped make the flow more orderly. On occasion, the Ethan EC-121 (COLLEGE EYE) aircraft lent radar coverage and some communications capabilities when needed. Units such as the 23d TASS and the 7th ACCS set up liaison programs to familiarize themselves with each other's problems. In the view of the Director of Operations of the 7th ACCS, a certain risk was inevitable when targets made concerted strike efforts necessary. He said: ^{52/}

"The subject of comparison between air traffic control and airstrike control is completely dependent upon the number of aircraft committed to an area. This is generated, of course, by the degree of activity within the area and the number of lucrative targets within that area. Within the present environment, all traffic control is no more than communications control. There are no visual data on the location of the various aircraft. Continual knowledge of the location of each and every aircraft is an impossibility; however, the controllers within the ABCCC aircraft are well aware of the areas assigned to each of the strike aircraft and to each of the FAC aircraft, and each individual is advised of the altitude at which the other is operating, and his particular area of authorization for the commitment of strike or armed recce missions.

"It has been the experience that under certain circumstances within a small area--a confined area with heavy traffic--that excessive numbers of aircraft are committed. However,

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altitude separations are assigned to each one of the strike flights. Each strike flight and FAC is well aware of the other's primary discrete frequency. And in all cases, all strike flights and FACs are made aware of strikes that are being put in at a particular time."

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FOOTNOTES

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GLOSSARY

AAA	Antiaircraft Artillery
AAAOB	Antiaircraft Artillery Order of Battle
ABCCC	Airborne Battlefield Command and Control Center
AGL	Above Ground Level
ACCS	Airborne Command and Control Squadron
ACIC	Aeronautical Chart and Information Center
AIRA	Air Attache
AMTI	Airborne Moving Target Indicator
AR	Actual Range
ASRT	Air Support Radar Team
BDA	Battle Damage Assessment
BLU	Bomb Live Unit
BR	BARREL ROLL
Cal	Caliber
CEA	Circular Error Average
CIF	Crew Information File
COC	Combat Operations Center
COMUSMACV	Commander, U.S. Military Assistance Command, Vietnam
CONUS	Continental United States
COORDS	Coordinates
CRC	Control and Reporting Center
CRP	Control and Reporting Post
CSS	COMBAT SKYSPOT
DME	Distance Measuring Equipment
DMZ	Demilitarized Zone
FAC	Forward Air Controller
FAG	Forward Air Guide
FAR	Forces Armee Royale
FLIR	Forward Looking Infrared
GP	General Purpose
HF	High Frequency
HVAR	High Velocity Aerial Rocket
IP	Initial Point
IR	Infrared
ISC	Infiltration Service Center
JUSMAG	Joint U.S. Military Advisory Group

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LLLTV	Low Light Level Television
LOC	Line of Communications
LORAN	Long-Range Navigation
MAP	Military Assistance Program
MR	Military Region
MTI	Moving Target Indicator
NBL	No Bomb Line
NKP	Nakhon Phanom
NM	Nautical Mile
NVA/PL	North Vietnamese Army/Pathet Lao
OL	Operating Location
PAT	Perishable Area Target
RBS	Radar Bomb Scoring
RLAF	Royal Laotian Air Force
ROE	Rules of Engagement
RP	Route Package
RTAFB	Royal Thai Air Force Base
RTB	Return to Base
RVN	Republic of Vietnam
SEA	Southeast Asia
SGU	Special Guerrilla Unit
SL/N	STEEL TIGER/North
SL/S	STEEL TIGER/South
SOW	Special Operations Wing
SPEC OPS	Specification Operations
SSB	Single Side Band
TACAN	Tactical Air Navigation
TACC	Tactical Air Control Center
TASS	Tactical Air Support Squadron
TCA	Traffic Control Area
TCP	Traffic Control Point
TDY	Temporary Duty
TFA	Task Force Alpha
TOT	Time Over Target
UHF	Ultra High Frequency
USAIRA	United States Air Attache
USMC	United States Marine Corps
USN	United States Navy
UTM	Universal Transverse Mercator

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VHF
VR

Very High Frequency
Visual Reconnaissance

WP
WW

White Phosphorous
World War

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